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Single Rod Vibration in Axial Flow NOAH WEICHSELBAUM, SHENGFU WANG, PHILIPPE BARDET, The George Washington University — Fluid structure interaction of a single rod in axial flow is a coupled dynamical system present in many application including nuclear reactors, steam generators, and towed antenna arrays. Fluid-structure response can be quantified thanks to detailed experimental data where both structure and fluid responses are recorded. Such datum deepen understanding of the physics inherent to the system and provide high-dimensionality quantitative measurements to validate coupled structural and CFD codes with various level of complexity. In this work, single rods fixed on both ends in a concentric pipe, are subjected to an axial flow with Reynolds number based on hydraulic diameter of Re =4000 . Rods of varying material stiffness and diameter are utilized in the experiment resulting in a range of dimensionless U between 0.5 and 1, where U = $(\rho A/EI)^{1/2}uL$. Experimental measurements of the velocity field around the rod are taken with PIV from time-resolved Nd:YLF laser and a high speed CMOS camera. Three-dimensional and temporal vibration and deflection of the rod is recorded with shadowgraphy utilizing two sets of pulsed high power LED and dedicated CMOS camera. Through integration of these two diagnostics, it is possible to reconstruct the full FSI domain providing unique validation data.

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